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Mutz et al.

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[54] CARD ROUTING APPARATUS

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[21] Appl. No.: **138,669**

Related U.S. Application Data

[62] Division of Ser. No. 818,523, April 23, 1969, Pat. No. 3,614,094.

[52] **U.S. Cl.** .....**235/61.9 R,** 101/93 C, 271/64

[51] **Int. Cl.** **B65h 24/58,** G06k 3/00

[58] **Field of Search**.....271/64, 52, 59; 235/61.9 R; 101/93 RC

[56] **References Cited**

UNITED STATES PATENTS

3,356,021	12/1967	May et al.	235/61.9 R
3,107,292	10/1963	Daly et al.	235/61.9 R

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[57] **ABSTRACT**

Cards are transported by reversible transporting means between an input station, a readout and recording station, and a printing station. Routing means are disposed between the input station, and the readout and recording station, for discharging returned cards, and other routing means are located between the readout and recording station, and the printing station, for discharging read out cards which need not reach the printing station. The routing means cooperate with reversible transporting means for the cards.

11 Claims, 12 Drawing Figures

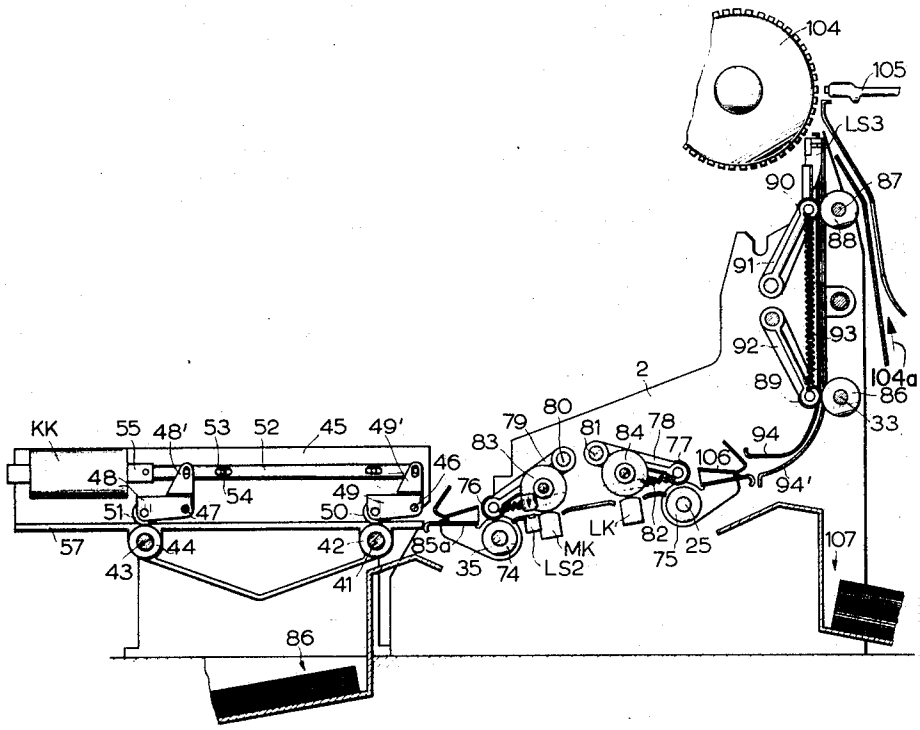
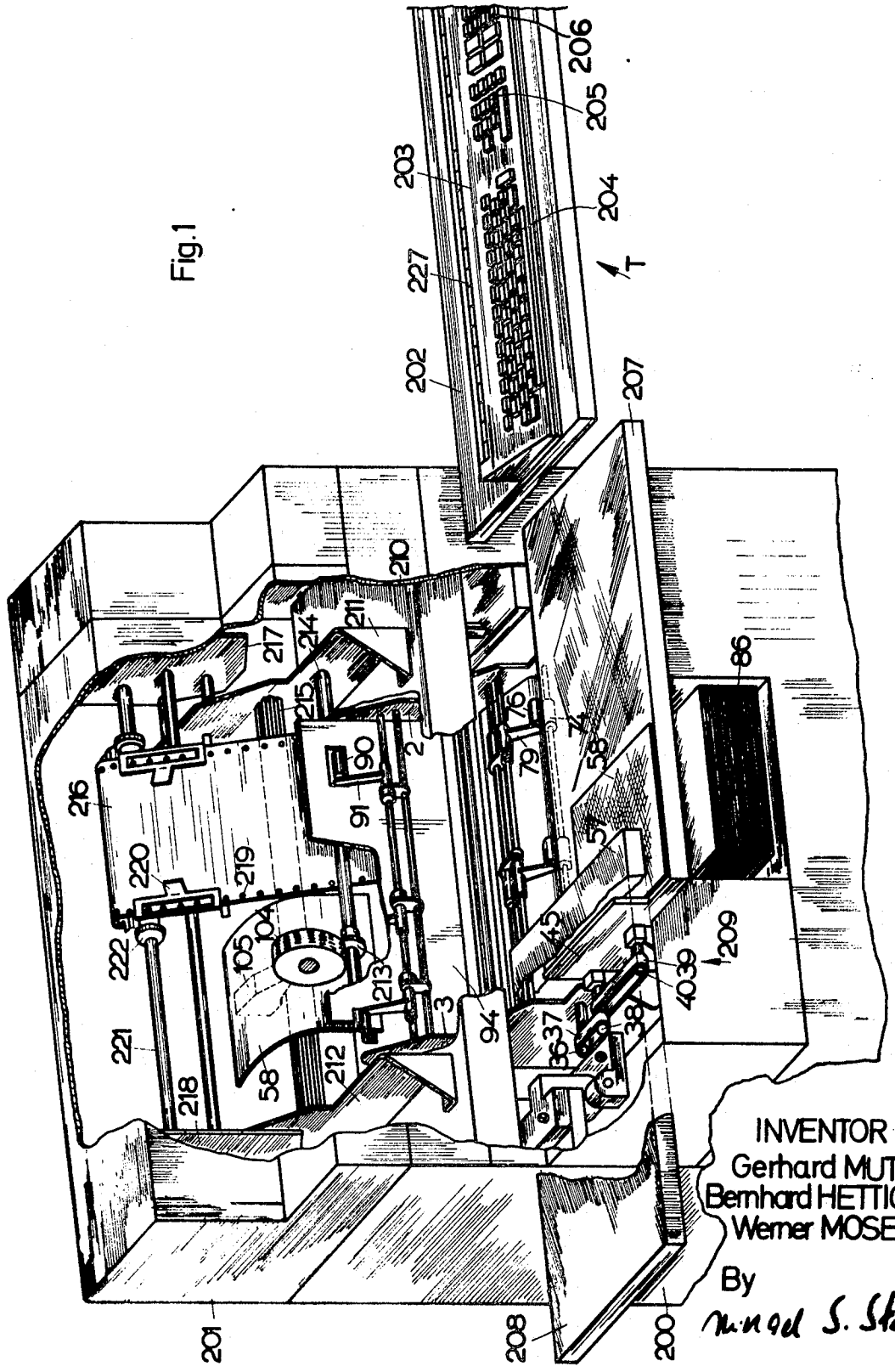


Fig.1



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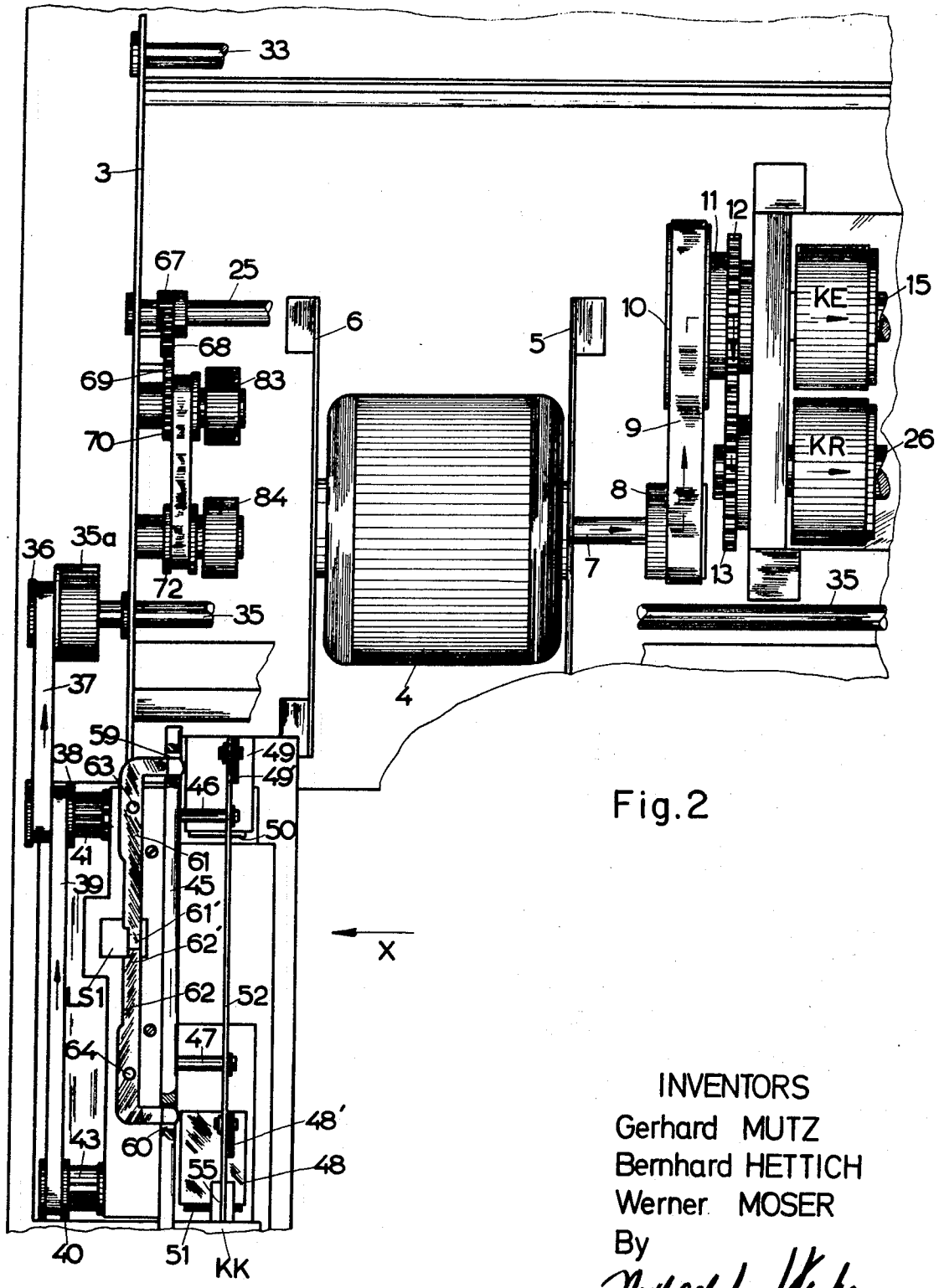

Fig.2

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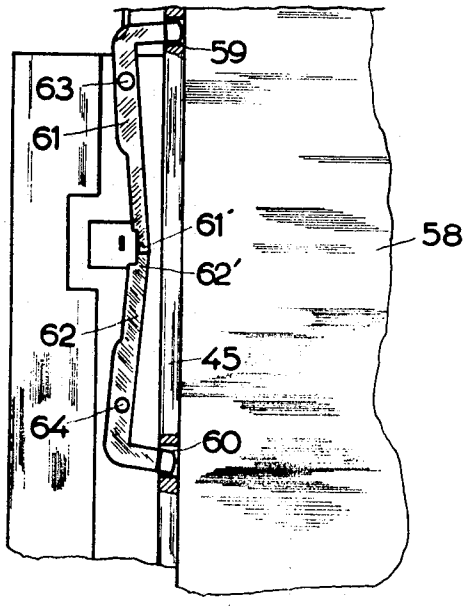

Fig. 2a

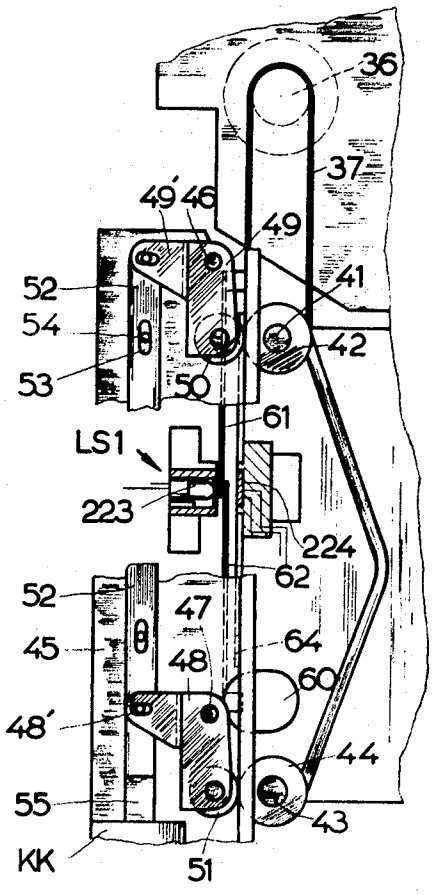

Fig.2b

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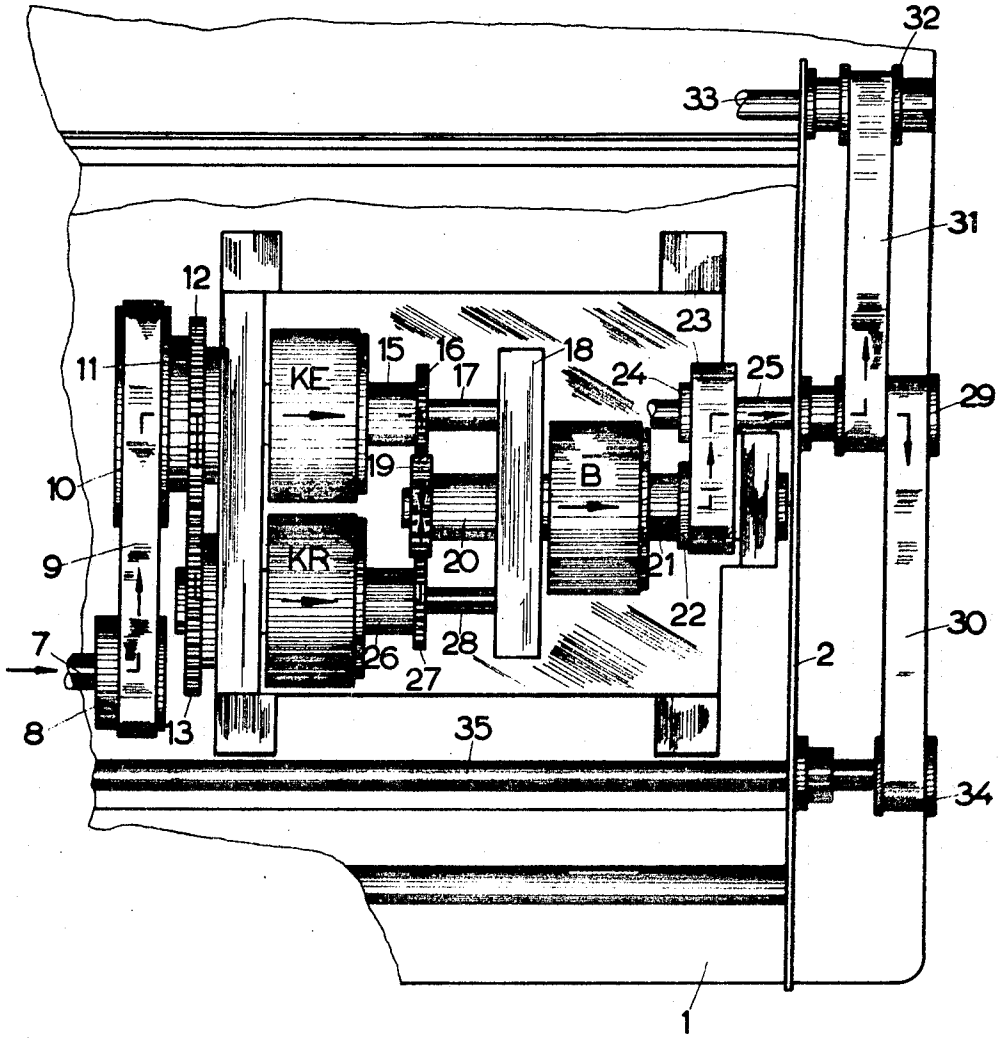

Fig. 2'

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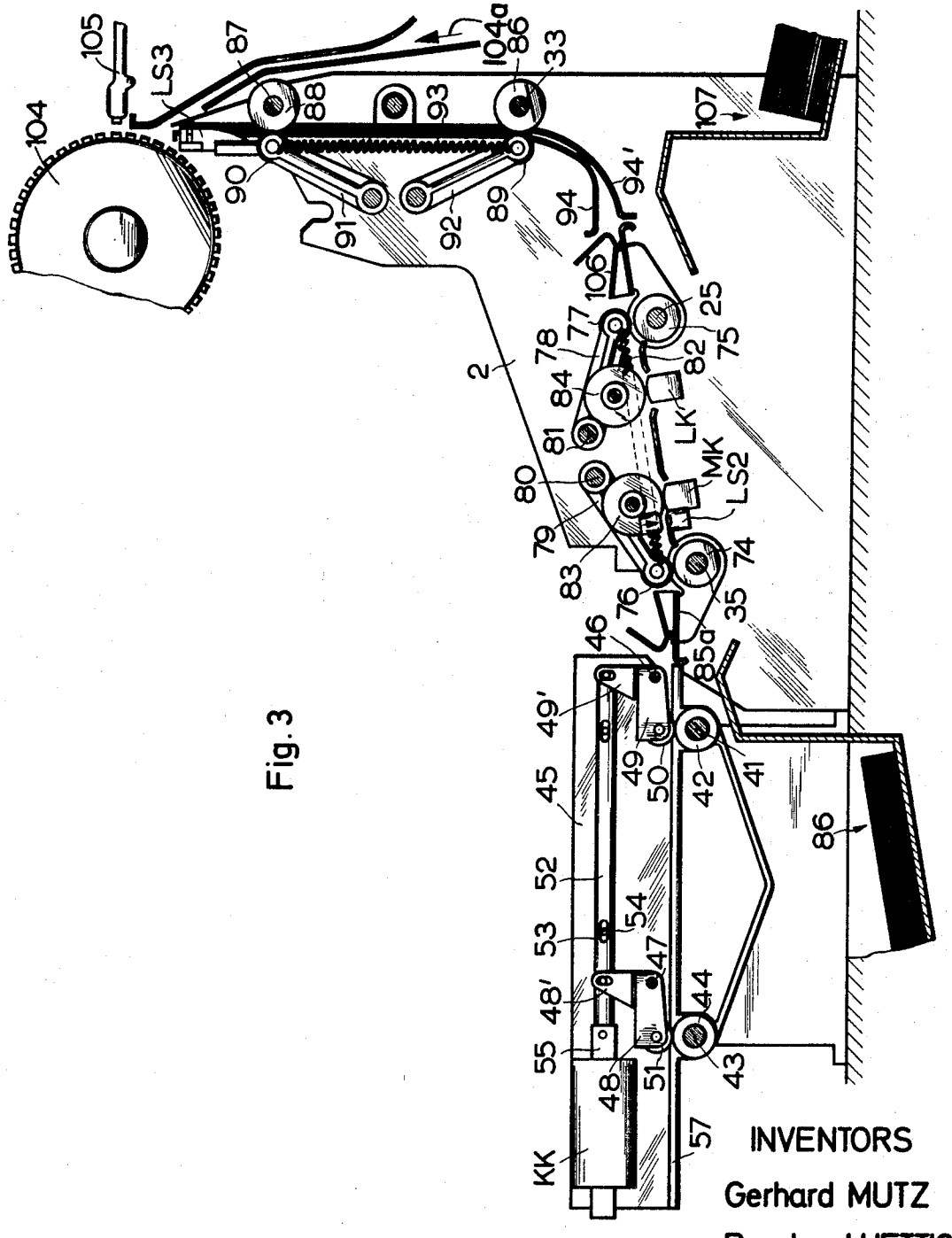

Fig. 3

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Fig. 4

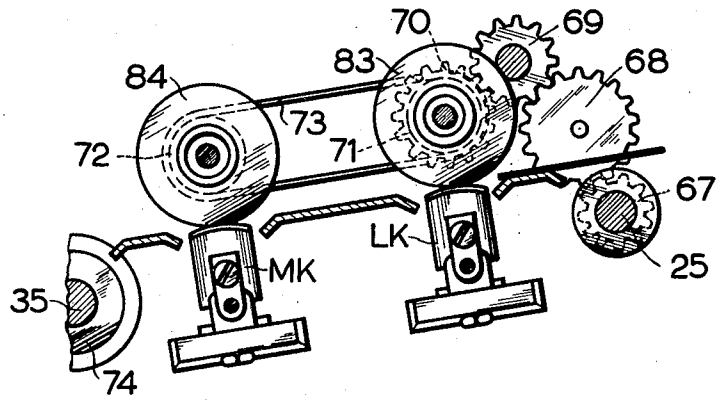


Fig. 5a

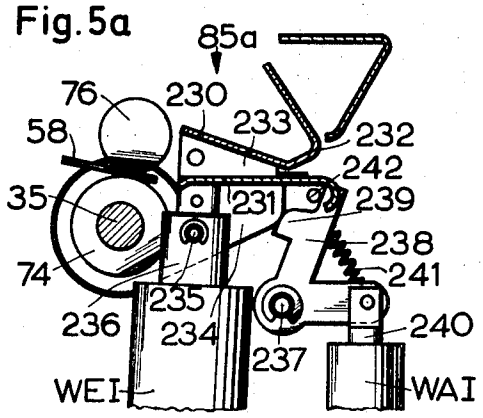


Fig. 5b

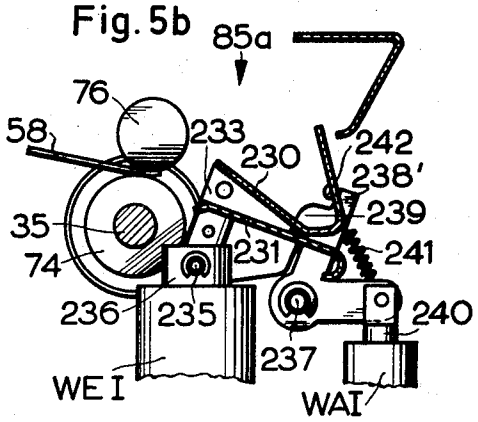
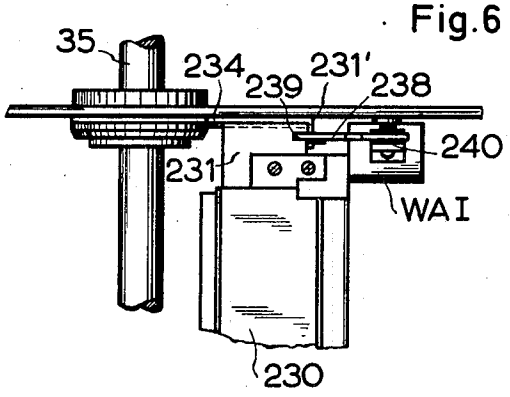


Fig. 6



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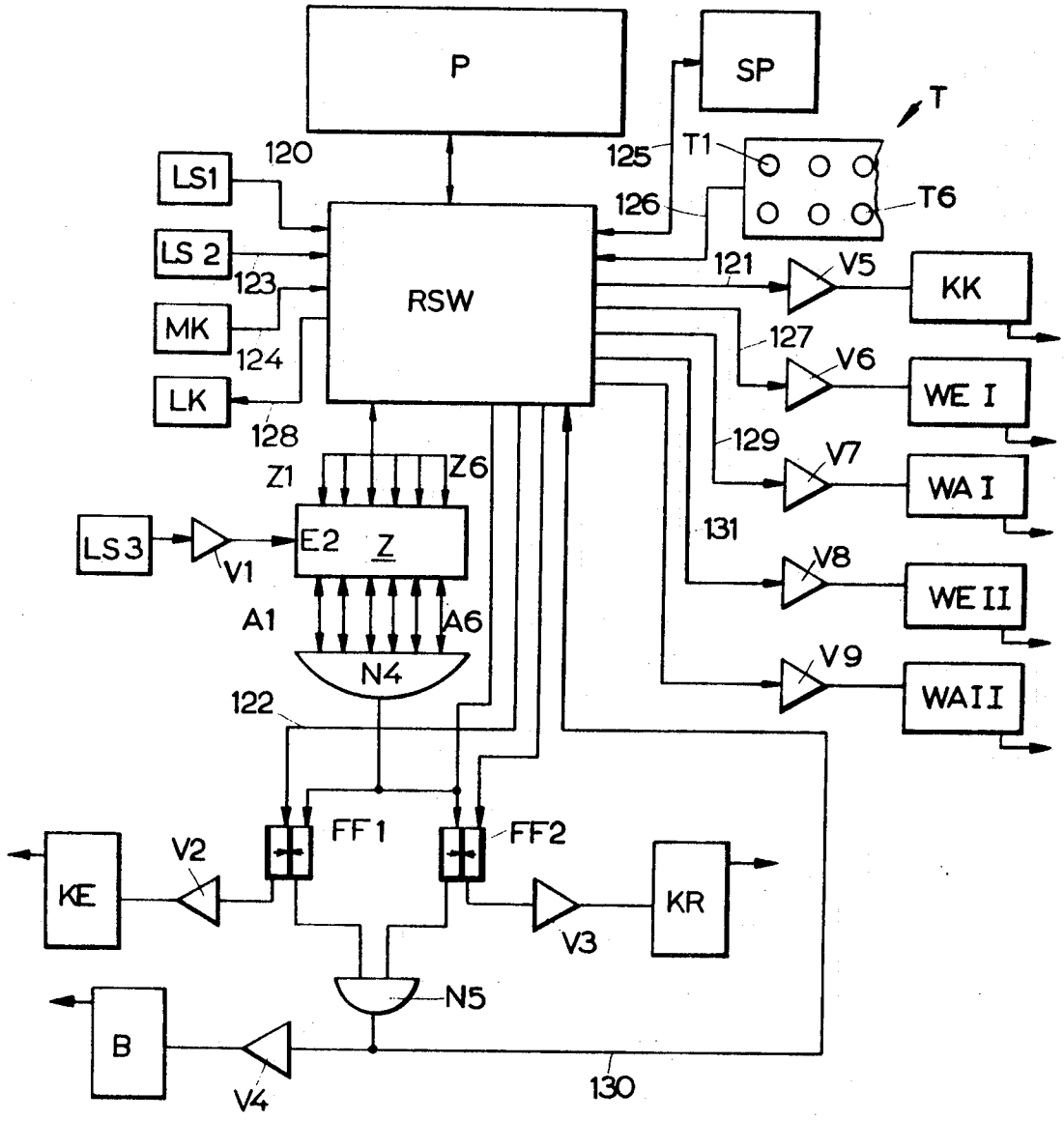

Fig. 7

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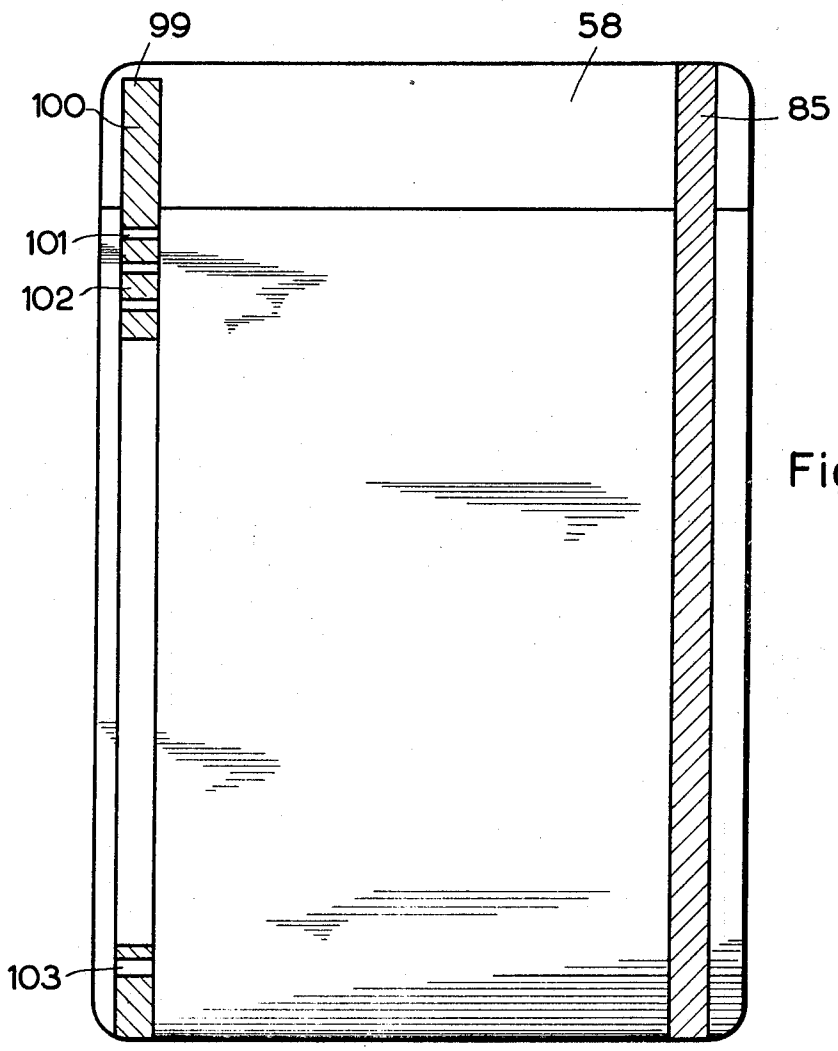

Fig. 8

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CARD ROUTING APPARATUS

REFERENCE TO RELATED APPLICATION

The present application is a divisional application of application Ser. No. 818,523, filed Apr. 23, 1969 now U.S. Pat. No. 3,614,094.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus by which cards are transported to a printing station which is controlled by a program controlled data processing computer, and by a manual keyboard. The printing station prints not only on interconnected forms, such as invoices, statements, and the like, which are folded in accordion pleats, but also on separate forms, such as account cards and the like. The account cards are generally not completed in a single printing operation, but are imprinted from time-to-time to indicate transactions occurring on the account. It is not only necessary to feed the cards in forward direction to the printing station, but it is necessary to transport the imprinted card in the opposite direction to a receptacle after, for example, a single line has been printed on a card. It is, of course, also possible to make copies of the newly imprinted account cards or forms.

In accordance with the prior art, single forms or cards are inserted into the paper carriage of the accounting machine, and the printing means are stationary. However, this construction requires the mounting of a guide frame for the form sheet or card on the paper carriage, which increases the weight of the same and results in slower movement of the paper carriage. It is desirable to reduce the mass of all moving parts of an accounting machine in order to obtain higher processing speeds during the printing, as well as during the input and discharge of the form sheets. It is also desirable to facilitate the insertion of the cards, for example, by placing the container for the account cards in the proximity of the input of the accounting machine.

Apparatus is known in which the account card is placed on a table below the keyboard and correctly positioned by at least two guide walls before the account card can be fed. This apparatus permits the use of account cards having a predetermined width.

SUMMARY OF THE INVENTION

It is one object of the invention to provide apparatus for making lists containing information related to different cards.

Another object of the invention is to assort cards, for example cards for accounts on which transactions have taken place, and other cards in whose accounts no transactions have taken place.

Another object of the invention is to route cards which are not to be imprinted to a discharge receptacle.

Another object of the invention is to imprint data derived from read out and discharged cards on a form sheet.

With these objects in view, one embodiment of the apparatus comprises an input station, a readout and recording station, a printing station, transporting means for transporting the cards from the input station to the printing station in a forward feeding direction and from the printing station to a discharge receptacle in the reverse feed direction, and routing means at the inlet and

outlet of the readout and recording station which are shiftable to discharge cards into corresponding receptacles.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic perspective view illustrating an embodiment of the data processing apparatus of the invention;

FIG. 2 is the left portion, and FIG. 2' is the right portion of a fragmentary plan view illustrating the reversible drive of the card feeding means, and the input station of the embodiment of FIG. 1;

FIG. 2*a* is a fragmentary plan view illustrating the positioning means of the input station;

FIG. 2*b* is a fragmentary side elevation of the input station;

FIG. 3 is a fragmentary side elevation of the apparatus;

FIG. 4 is a fragmentary side elevation illustrating the readout and recording station of the apparatus on a larger scale;

FIG. 5*a* and 5*b* are fragmentary side elevations on a larger scale illustrating two positions of a routing means of the apparatus;

FIG. 6 is a fragmentary plan view of the routing means in the position of FIG. 5*b*;

FIG. 7 is a schematic diagram illustrating the electric control circuit of the apparatus; and

FIG. 8 is a plan view of an account card which can be processed by the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

General Arrangement

Referring to FIG. 1, a printer housing **201** is mounted on a supporting console **200** in which the electronic data processing computer and its programming means are preferably located. On the right of the printer, a keyboard **203** is provided which includes an alphanumerical typewriter keyboard **204**, a digital keyboard **205**, and an operation control keyboard **206**. Keyboard **204** serves for writing the text, keyboard **205** serves for entering all digital values which have to be processed in the computer, while keyboard **206** serves for starting operations in cooperation with the programmed data processing computer. All keys of keyboards **204, 205, 206** operate electric switches so that the keyboards are connected by a cable consisting of a plurality of conductive wires with the data processing computer. An array of luminous indicator areas **227** is disposed above the keyboard **204, 205** and **206** which may serve the indication of different operational conditions of the data processing computer, of the printer, of the card feeding means, and of other auxiliary devices which may be used, for example feeding means for punch cards or for punch tape, and discharge means for the same.

On the left of the table **202**, a table **207** is mounted on the supporting means **200** which is bounded on the

left by an abutment plate 57 to which a vertical guide wall 45 is secured which serves for positioning the account card 58. Guide wall 45 is located below a table 208 which is located at the same level as table 202. The card input station 209 is located below table 208 and includes a plate 57. A card receptacle 86 is supported under table 207. Two vertical support walls 2 and 3 are provided on opposite sides of the card feeding drive and support the shafts of the same, as will be described in further detail with reference to FIGS. 2 and 3.

A base plate 210 carries the lateral support walls 211 and 212 for the printer which constitutes a unit connected by screws, not shown in FIG. 1, with the supporting means 200 which also carries the card feeding drive. The printer has a printing cylinder 104 which is continuously rotated by a gear 213 driven from a shaft 214 which is rotatably mounted on support walls 211 and 212. Printing cylinder 104 can be tabulated to the left and right in a manner which is not an object of the present invention, and is provided with eight circular peripheral rows of types, corresponding to a complete alpha numerical system so that eight characters or digits can be simultaneously printed by printing cylinder 104 in cooperation with an axial row of eight printing hammers which are disposed behind the form to be printed and the account card 58. Printing hammers 105 are driven by pawls coupled with a snatch roll 215, after selection of a particular type. The printer is not an object of the present invention.

Transporting means for a band consisting of connected forms 216 can also be mounted between support walls 2, 3 in addition to the feeding means for the account cards 58. The form band 216 is provided with transporting holes 219 arranged along the lateral edges of the same, and is driven by sprocket belts, not shown, engaging transporting holes 219. Flaps 220 which are mounted on the supports of the sprocket belt, serve the purpose of guiding forms 216 securely over the sprocket belt which is driven from a shaft 221 by means of gears 222. The transporting means for the band of interconnected forms is not an object of the invention.

It should be noted, however, that the printer, mounted between support walls 211 and 212, the feeding and transporting drive for the cards 58, mounted between support walls 2 and 3, and also the transporting means for the band of forms 216 are separate complete units, permitting a selective combination of the printer with the form tape transporting unit, with the feeding unit, as well as with both units.

Card Feed Control Station

REferring now to FIGS. 2, 2*a*, 2*b* and 3, base plate 1 carries lateral support walls 2 and 3. A motor 4 is mounted between two support walls 5 and 6 on base plate 1, and drives a shaft 7 carrying a pulley 8 driving a belt 9 and a pulley 10 connected by a sleeve 11 with a gear 12 meshing with another gear 13 and being connected with the input part of an electromagnetic card feed clutch KE whose output part is connected by a sleeve 15 with a gear 16 mounted on a shaft 17 carried by a support wall 18. Gear 16 meshes with a gear 19 connected by a sleeve 20 with shaft 21. An electromagnetic brake B has a rotary part connected with shaft 21, and a stationary part. Shaft 21 drives a pulley 22 which rotates a shaft 25 by belt 23 and pulley 24.

Gear 13 is connected with one part of an electromagnetic card feed reverse clutch KR whose other coupling part is connected by a bushing 26 with a gear 27 and mounted on a shaft 28. Gear 27 meshes with gear 19. Card forward feed clutch KE and card reverse feed clutch KR and brake B are selectively energized, and when none of the clutches KE and KR is engaged, brake B is energized and blocks rotation of card feed control shaft 25 and prevents feeding of a card. When electromagnetic brake B is disconnected, either feed clutch KE, or reverse feed clutch KR is engaged for driving feed control shaft 25 in one or the other direction of rotation. When card feed clutch KE is energized, the card feeding means are driven from motor 4 by means of shaft 7, pulleys 8 and 10, shaft 15, gear 16, gear 19, shaft 21, pulleys 22 and 24 in the feeding direction so that a card is fed from the card table 207, 57 to the printing station between printing cylinder 104 and printing hammers 105. If feed reverse clutch KR is energized, motor 4 drives shaft 25 by pulleys 8 and 10, gears 12 and 13, clutch KR, gear 27, gear 19, shafts 20 and 21, and pulleys 22 and 24. The electromagnetic brake B stops the entire drive, when energized.

Card Input Station

Feed control shaft 25, which is mounted between support walls 2, 3 carries a double pulley 29 whose parts drive two belts 30 and 31 respectively driving pulleys 32 and 34 for rotating shafts 33 and 35, respectively, which are both mounted on support walls 2 and 3. The left end of shaft 35 projects beyond support wall 3 and drives through a one-way clutch 35*a*, see FIG. 2, a pulley 36 only in one direction, corresponding to forward feeding of the card. Pulley 36 drives through a belt 37, a double pulley 38 which drives a belt 39 passing over a pulley 40. Pulley 38 is secured to a shaft 41 carrying a driving transporting roller 42, while pulley 40 is connected with a shaft 43 carrying a driving transporting roller 44. Transporting rollers 42 and 44 are shown in FIGS. 3 and 2*b* and serve for feeding cards in cooperation with pressure transporting rollers 50 and 51 rotatably supported on carrier levers 48 and 49 mounted on pivot pins 46 and 47 for angular movement with pressure rollers 50 and 51. Carrier levers 48 and 49 have upper arms 48' and 49' which are mounted by means of a pin-and-slot connection on a shifting bar 52 which has longitudinal slots 53 guided on studs 54 on guide wall 45. Bar 52 is connected with the armature 55 of a card feed control electro magnet KK which, when energized, pulls bar 52 to the left against the action of a spring, not shown. When carrier levers 48 and 49 are angularly displaced by electromagnet KK, pressure rollers 50 and 51 engage the driving transporting rollers 42 and 44 so that the card is transported in a feeding direction toward the right as viewed in FIG. 3, feeding in the opposite direction being not possible due to the provision of the one-way clutch 35*a* in the transmission between feed control shaft 25, and driving transporting rollers 42 and 44. When the electromagnetic brake B is not actuated, and the card feed clutch KE is energized, driving transporting rollers 42 and 44 are driven. However, due to the action of the spring, not shown, acting on bar 52, pressure rollers 50 and 51 are spaced from driving transporting rollers 42 and 44, until electromagnet KK is energized for starting feeding of a card located between the pairs of transporting rollers 42, 50 and 44, 51.

The guide wall 45 is vertical and perpendicular to the horizontal top surface of cardtable 57, 207 on which the card 58 is placed in a position in which a lateral edge of the cards abuts the guide wall 45 while the card

is located between the pairs of transporting rollers **44, 51** and **41, 50.** Guide wall **45** has two openings **59** and **60** through which end portions of two feeler levers **61** and **62** project beyond the guiding surface of guide wall **45** in the plane in which the card is located. The feeler levers **61** and **62** are mounted on pivots **63** and **64** and have inner adjacent ends cooperating with a light barrier LS **1.** In the normal position of rest, feeler levers **61** and **62** are in the position of FIG. **2** in which the path of the light within the light barrier LS **1** is interrupted since the end portions **61'**, **62'** block the rays of light between a source of light **223** and a photocell **224,** as best seen in FIG. **2***b*. When a card **58** is positioned on table **57** with its lateral edge abutting the guide surface of guide wall **45** and the end portions of feeler levers **61** and **62,** the same are displaced so that the end portions **61'** and **62'** open the path of light within the light barrier LS **1** so that the photocell **224** generates a pulse energizing feed control electromagnet KK so that pressure rollers **50** and **51** press the card against driving transporting rollers **42** and **44** so that the card is fed toward the right as viewed in FIG. **3.**

Readout Station

The reversible feed control shaft **25** is driven by a gear **67** and meshing gears **68, 69** and **70** and pulleys **71, 72,** and a belt **73.** Pulleys **71** and **72** are mounted on shafts carrying driven pressure rollers **83** and **84** and are driven from feed control shaft **25** by means of the transmission **67** to **70** in the same direction as shaft **25.** Shafts **25** and **35** carry driving transporting rollers **74** and **75** cooperating with pressure transporting rollers **76** and **77,** see FIG. **3,** mounted on lever arms **78** and **79** pivotally supported on shafts **80** and **81** on support wall **2,** and normally held by spring **82** connecting levers **78, 79** in a position abutting transporting rollers **74** and **75.** Pressure rollers **83** and **84** press card **58** during feeding in the feeding direction, and also during reverse feeding in the opposite direction, against two magnetic heads, namely magnetic head MK serving for readout and also for recording, and the magnetic clearing head LK, see FIGS. **3** and **4.** Clearing head LK serves for erasing magnetic recordings recorded on a magnetizable strip or tape on account card **58,** see FIG. **8.** Magnetic head MK reads out information from magnetizable strip **85** during feeding movement of the account card **58,** and also records new information concerning newly computed data during the reverse feeding of the card from the right to the left, as viewed in FIG. **3** toward the receiving receptacle **86** in which discharged cards are collected.

As shown in FIG. **8,** the account card **58** has along its right edge the magnetizable strip **85,** and along its left edge a control strip **99** which has black portions **100, 102** interrupted by reflecting portions **101, 103** and cooperating with a light barrier LS **3,** as will be explained hereinafter. Strips **85** and **99** are provided on both sides of the account cards in registering positions. The magnetic heads MK and LK cooperate with the magnetizable strip **85** on the bottom face of the account card **58.** The positions of magnetic heads MK and LK, and also of the light barriers LS **1,** LS **2** and LS **3,** which will be described hereinafter, are adjusted only in relation to the guide wall **45** by which the account card **58** is also positioned. The light barrier LS **2** is past by the leading edge of a fed card before the same reaches magnetic head MK, and produces a signal indicating the presence of a card at the readout station and causing by means of the programmed computer the energization of the magnetic head MK for reading out data recorded on magnetizable strip **85.**

Routing Means

Between the card input station **209** with card table **57** and guide wall **45,** and the readout station including magnetic heads MK and LK, a routing means or mechanical switch **85***a* is disposed which in the normal position shown in FIG. **3** and FIG. **5***a*, permits the feeding of the card to the readout station. In the position of FIG. **5***b*, routing means **85***a* routes a card downward into the receptacle **86** after the card has been transported in reverse feeding direction through the readout station. FIGS. **5***a* and **5***b* show routing means **85***a* in a reversed position as compared with FIG. **3** since the elevation of FIGS. **5***a* and **5***b* is viewed from the opposite side of the apparatus, as compared with FIG. **3.**

Routing means **85***a* includes an upper guide plate **230** and a lower guide plate **231** extending over the entire transverse width of table **57.** The upper guide plate **230** is bent upward so that the edge **232** provides guidance for the entering account card. The guide plates **230** and **231** are secured to each other by bent projections. The angular portion **234** is connected with the upper part of guide plate **230** and with the lower part **231,** and centers routing means **85***a* in relation to shaft **35.** A spring, not shown, holds routing means **85***a* in the normal position shown in FIG. **5***a*. The projection **233** is connected to the armature **236** of a first routing electromagnet WE **1** by a pivot **235.** A double armed pawl **238** is mounted on a stationary pivot **237** and is provided with a locking projection **239.** The right arm of pawl **238** is articulated to the armature **240** of a second routing electromagnet WA I. A spring **241** is connected with armature **240** and with a stationary stud **242** and biasses armature **240** out of the coil of the first routing electromagnet WA **1** until the pawl abuts with a nose **238'** on a stop **242.**

The lower guide plate **231** has an arresting edge **231'**, best seen in FIG. **6,** cooperating with a locking projection **239** of pawl **238.** When the first routing magnet WE I is energized, the guide plates **230** and **231,** forming the routing means **85***a*, are together pulled downward so that guide plates **230** and **231** assume the position of FIG. **5***b*. During this operation, pawl **238** is displaced until locking projection **239** engages and arrests the abutment edge **231'** so that the routing means **78***a* is arrested in the displaced position in which the card is guided below table **57** and discharged into a receptacle **86.** In the normal position of FIG. **5***a*, the card is guided from input station **209, 57, 45** to the readout station, as is apparent from FIG. **3.** From the position of routing means **85***a* shown in FIG. **5***b*, it is apparent that the edge **232** of the upper guide plate **230** blocks entry of a forwardly transported card into the routing means so that no new card can be fed from the input station into the readout station as long as routing means **85***a* is in the discharge position shown in FIG. **5***b*. In order to return the routing means **85***a* to its normal position, the second routing electromagnet WA I is energized so that pawl **238** is displaced in clockwise direction and releases the lower guide plate **231,** permitting return of routing means **85***a* under the action of a spring, not shown, to the normal position of FIG. **5***a* and FIG. **3.**

Following the readout station and transporting rollers **77, 75,** another routing means **106** is provided which is

constructed as described with reference to the routing means 85a. In the normal position of the apparatus, routing means 106 is in the normal position of FIG. 3, permitting passage of a card transported by transporting rollers 77,75 into a chute formed of guide walls 94 and 94', and leading to the printing station indicated in FIG. 3 by printing cylinder 104 and printing hammers 105. When routing means 106 is angularly displaced under the control of another first routing electromagnet WE II, see FIG. 7, the transported card is guided downward into receptacle 107 so that the card is not transported to the printing station. Routing means 106 is returned by a spring, not shown, to the normal position by operation of the second routing electromagnet WA II, see FIG. 7.

By suitably positioning routing means 85a and 106, it is possible to transport the card from the input station along a first path through the readout station with magnetic heads MK and LK, and along a second path defined by transporting rollers 86, 89 and 88, 90 to the printing station 104, 105. When the imprinted card is transported in the opposite direction by reversed transporting means, the routing means 85a is turned to the discharge position, so that the returning card is discharged into receptacle 86 after passing through the readout station.

On the other hand, it is also possible to shift routing means 106 out of its normal position to the discharge position so that a card transported from the input station 57, 45 in the normal feeding direction is guided into receptacle 107 after passing through the readout station. As a result, it is possible that the card passes the input station and the readout station and is discharged and collected, without arriving at the printing station in a printing position. In this manner, values which are recorded on the card, can be read out by a magnetic head MK in the readout station and recorded or printed on a band consisting of interconnected forms 104a shown in FIG. 3 on the right of transporting rollers 88. At the same time, routing means 85a and 106 prevent movement of cards in a wrong direction and before certain operations have been completed.

Printing Station

As shown in FIG. 3, shaft 33 carries transporting rollers 86. Shaft 33 is connected by pulleys, not shown, and belt 31 with a shaft 87 carrying transporting rollers 88. Pressure rollers 89 and 90 cooperate with the driving transporting rollers 86 and 88, and are mounted on levers 91 and 92. Springs 93 bias levers 91 and 92 to engage with rollers 89 and 90 the transporting rollers 86 and 88. Guide plates 94 and 94' form a chute for guiding the forward fed cards to the pairs of transporting rollers. Above the pair of transporting rollers 88, 90, a photoelectric light barrier LS 3 is disposed. The source of light and the photocell of light barrier LS 3 are arranged on the same side of the card 58, and the light emitted by the source of light is reflected by the surface of card 58 and then enters the photocell. The light barrier LS 3 cooperates with the control strip 99 provided on the left side of the card 58, as shown in FIG. 8, and has an upper black portion 100 covering the entire heading of the account card which represents the name and address of a customer. The black portion 100 is followed at equal intervals by bright markings 101 interrupted by black markings 102. All bright markings 101 are of the same width and spaced in accordance with the lines of card 58. Preferably, the dark marks 102 are somewhat wider than the bright marks 101. Only the last line of the card is associated with the bright mark 103 which is wider than the other bright marks 101 for a reason which will be explained hereinafter.

When the card has passed the photoelectric sensing means LS 3, it arrives at the printing station in a position located between the print cylinder 104 and the corresponding printing hammers 105.

Control Circuit

Referring now to FIG. 7, an electronic data processing computer cooperates with a programming means P. An electronic storage means SP is provided with any selected number of storing members by which not only certain values are stored during feeding of the card, but which also are used for temporary storage of data during the processing. A keyboard T controls switches connected with computer RSW by operation of keys, only six keys T_1 to T_6 being shown. The partly shown keyboard T corresponds to the operation controlled keyboard 206 described with reference to FIG. 1. Feed control electromagnet KK, the routing magnets WE I and WA I of routing means 85a, and the routing electromagnets WE II and WA II of routing means 106, are connected by amplifiers V 5 to V 9, respectively, with computer RSW.

Light barriers LS 1 and LS 2 are connected by lines 120 and 123 with computer RSW to which readout head MK and clearing head LK are connected by lines 124, 128, respectively.

A binary counter Z has six stages and can count up to the number 63. Six presetting lines Z_1 to Z_6 connect counter 1 with computer RSW, and serve the purpose of presetting counter Z to a predetermined numerical value which is required for the determination of the line position. Counter Z has an input E 2 connected by an amplifier V 1 with the photoelectric sensing means LS 3. Counter Z has six output lines A_1 to A_6 which, when all receive an "L" signal, render an AND gate N 4 conductive so that two flip-flops FF 1 and FF 2 are actuated so that flip-flop FF 1 assumes the condition "O L" and flip-flop FF 2 assumes the condition "L O". The left part of the flip-flop FF 1 and the right part of flip-flop FF 2 are connected with computer RSW. The left part of flip-flop FF 1 is connected by the amplifier V 2 with the forward feed clutch KE, while the right part of flip-flop FF 2 is connected by an amplifier V 3 with the reverse feed clutch KR, see FIG. 2. The right output of flip-flop FF 1 and the left output of flip-flop FF 2 are both connected to an AND gate N 5 which is connected by an amplifier V 4 with the electromagnetic brake B.

OPERATIONS

Card Input and Positioning

Card 58 has on the magnetizable portion 85 data which are to be processed in computer RSW, but also recordings indicating the next line at which the card has to be stopped, and the number of the next line to be processed is recorded in complementary form on the magnetizable strip 85. Since counter Z has a maximum capacity of 63, the number of the next line is stored as the complementary value to the number 63. For example, if the next line of the card is line 15, the complementary value, namely 48, is recorded on the magnetizable strip 85.

The card is positioned on table 57 with a lateral edge abutting guide wall 45 and displacing the end portions

of feeler levers **61** and **62** so that the same open a path for the light rays of the source of light **223** to the photocell **224** so that light barrier LS **1** generates a signal transmitted through line **120** to the computer RSW. In accordance with the program, it is now determined whether one of the routing magnets WEI, WA I, WE II, and WA II, is energized. If this is not the case, the processing of the preceding card has been completed, and the routing means **85***a* and **106** are in the normal position shown in FIG. **3**. Under control of the program, the computer RSW produces a signal transmitted through line **121** and amplifier V **5** to the feed control electromagnet KK so that pressure rollers **50** and **51** press the card against the transporting rollers **42** and **44** in the card input station so that the card is held in the same in the correctly aligned position. It should be noted that in the event that the card is not abutting guide wall **45** and has not displaced both feeler levers **61** and **62**, the light barrier LS **1** has not generated a signal so that feed control electromagnet KK cannot operate carrier levers **48, 49** by bar **52** for clamping and holding the card at the input station.

Card Feeding

The next command from programming means P is transmitted by computer RSW through line **122** to the flip-flop FF **1** so that its left side becomes conductive. This results in energizing of the forward feed clutch KE. The switching of flip-flop FF **1** locks the AND gate N **5** so that brake B is de-energized. Motor **4** drives shaft **7**, pulleys **8, 10**, gears **16, 19**, shaft **21**, pulleys **22, 24** and feed control shaft **25** in the forward feeding direction. Shaft **25** drives by belts **31** and **30** shafts **33** and **35** so that transporting rollers **42, 44**, transporting rollers **74, 75**, pressure rollers **83, 84**, and transporting rollers **86** and **88** are driven and transport card **58** in the feeding direction.

Shafts **41** and **43** carry only one transporting roller **42** and **44**, respectively, while several transporting rollers **74, 75, 86, 88** are respectively spaced in transverse direction on shafts **35, 25, 33, 87**. In the event that a card **58** assumes a slanted position due to the one-sided transporting force applied by transporting rollers **44** and **42** before reaching the plurality of transporting rollers **74**, one of the feeler levers **61** or **62** would be released by the lateral edge of the card, and light barrier LS **1** would indicate the disturbance by a signal so that pressure rollers **50, 51** would be withdrawn, and the feeding of the cards stopped.

Readout

After passing through the routing means **85***a*, the card is fed through the light barrier LS **2** which generates a signal passing through line **123** to the computer RSW and indicates the presence of a card at the readout station so that computer RSW in accordance with a program command energizes magnetic head MK. The magnetizable strip **85** on the card **58** is transported through the readout station and passes readout head MK which reads out the information recorded on the magnetizable strip **85**, and the read out data are transmitted by computer RSW under the control of the program of the programming means P, through line **125** into different storing members of electronic storage device SP. The first value recorded on the magnetizable strip **85** is the identification of the next line of the card in which data have to be processed. At the same time, this read out value is used for setting counter Z through lines Z_1 to Z_6 to the complementary value of the line read out by the readout head MK.

When the trailing edge of card **58** has passed the light barrier LS **2**, and if during the continuous readout no error has been discovered, light barrier LS **2** transmits a signal through line **123** which, together with a program command, is now used for energizing routing magnet WE I by way of amplifier **6** and line **127**. When the card has completely passed routing means **85***a* and no error has been discovered, routing magnet WE I is energized and shifts routing means **85***a* to a position for guiding a return card under table **57** into receptacle **86** at a later time. On the other hand, the routing means **85***a* in the discharge position of FIG. **5***b*, prevents the feeding of another card from the input station **209, 57, 45**.

The card is transported by pairs of transporting rollers **75, 74** through routing means **106** in the normal position an further in chute **94, 94'** by pairs of transporting rollers **86, 89** and **88, 90** along a second path to the printing station **104, 105**.

Positioning for Printing

When the leading edge of the transported card reaches the photoelectric sensing means LS **3**, the line control strip **99** is sensed, and each bright mark **101** sensed by the photoelectric sensing means LS **3** generates a pulse which is transmitted by amplifier V_1 to the input E **2** of counter Z which is counted from the complementary value to which it was set, until reaching full capacity. At this moment, all output lines A_1 to A_6 of counter Z receive "L" signals, and the AND gate N **4** becomes conductive so that flip-flop FF **1**, which was conductive on the left, is switched to the condition "O L" in which its right side is conductive. Since flip-flop FF **2** is anyway in the condition "L O", the AND gate N **5** is actuated and brake B energized over amplifier V **4**. At the same time, the switching of flip-flop FF **1** disconnects the card feed clutch KE so that the card is arrested and held between the transporting rollers **88, 90** in the position in which printing can take place in the required line.

Line spacing in forward and return direction can be effected by programming means P and storage means SP, and of computer RSW by means of counter Z when a key of the keyboard T is operated. This operation is not an object of the present invention.

Card Discharge

When the card has been processed, a certain program of the programming means P is completed, and the program effects the reverse feeding of the card either under the control of the programming means, or under the control, of one of the function keys T**1** to T**6**. In the latter case, operation of key T **1** transmits a signal through line **126** which selects in the programming means a particular subprogram controlling the card discharge.

When the card is transported in the reverse direction from the printing station and through the readout station, the card passes through light barrier LS **2** which generates a signal effecting, among other functions, energization of amplifiers for the magnetic head MK which now performs the function of a recording head, while a signal transmitted by line **128** energizes the clearing head LK. The number identifying the last processed line, which was stored in electronic storage means SP is transmitted to the computer RSW with a change corresponding to the number of line spacing

operations which have taken place in the meantime, augmented by an additional unit for presetting the next following line for the next operation. For example, assuming that the last processed line was line **15**, the record carrier strip **85** contained before the processing of the card, a recording representing the complementary value **48** of the line number **15** with reference to the maximum capacity of counter Z. If during the processing of the card, two line spacing operations were carried out in forward direction, the line number stored in electronic storage means SP is changed to **46**. Before the card returns, the line value stored in electronic storage means SP is reduced by one unit to **45**, which causes transport of the card to line **18** during the next processing of the card. It has to be considered that not only line **15**, but also lines **16** and **17** were printed so that the next free line on the card is line **18**, and the card must be stopped at the printing station in a position in which the next free line **18** is located in the printing plane defined by hammers **105**.

Before the return of the card from the printing station, the complementary value of the next line to be printed is stored in storage means SP.

By a further program command signal, computer RSW switches flip-flop FF **2** over line **129** so that flip-flop FF **2** is in the condition "O L". Electromagnetic brake B is de-energized, while card reverse clutch KR, see also FIG. **2**, is energized over amplifier V **3**. The transmission between motor **4** and feed control shaft **25** is reversed by the use of gears **12** and **13**, so that feed control shaft **25**, and shafts **33**, **35** connected therewith, rotate in the opposite direction whereby the transporting rollers transport the card from the printing station in a reverse feeding direction. The card passes routing means **106** in the normal position and over erasing or clearing head LK so that all data on the record carrier strip **85** are erased since erasing head LK was connected by a control pulse generated by light barrier LS **2**. The card then passes over magnetic head MK, which is now connected to be a recording head, and almost simultaneously through the light barrier LS **2**. The magnetic head MK records the data stored in storage means SP during the preceding processing on the record carrier strip **85** of card **58**. Finally, the magnetic head MK records the complementary value of the next following line which is to be imprinted, for example number **45** is recorded in binary form as "L O L L O L". The light barrier LS continuously senses the presence or absence of a card at the readout and recording station, and when the card has passed completely through the light barrier LS **2**, a second routing magnet WA I of routing means **85***a*, see FIGS. **5***a* and **5***b*, is energized over amplifier V_7 after a certain delay, so that routing means **85***a* is turned to the discharge position of FIG. **5***b* and the card is guided under the table **57** and into the receptacle **86**. After shifting of routing means **85***a*, a further program command signal transmitted by line **130** switches flip-flop FF **2** to the "L O" condition so that the AND gate N **5** becomes conductive, and electromagnetic brake B is energized over amplifier V **4**, while the card reverse feed clutch is de-energized. A control signal is simultaneously returned over line **130** to the computer RSW which indicates that the apparatus is in its normal position of rest, so that another card can be fed.

It should be noted that a new card **58** may already be positioned at the input station **209** clamped by the pairs of rollers **45, 51** and **42, 50** in a position of readiness, even before the preceding card has been discharged into receptacle **86**. Since transporting rollers **42, 44** are driven by a transmission including the one-way clutch **35***a*, rollers **42** and **44** are at a standstill during the reverse feeding of the card which takes place during the card discharge.

Listing of Accounts

Accounting operations require the making of lists registering the balances of all accounts separated for credit and debit, and finally added. The apparatus of the invention permits listing operations by the use of routing means **106** which for this purpose is shifted to the position for guiding a card into the receptacle **107**. Such shifting takes place under the control of a key T_6 which produces a control impulse of computer RSW to the respective routing electromagnet WE II. Operation of key T_6 closes a switch producing a pulse through line **126** which controls computer RSW so that a signal over line **131** and amplifier V **8** energizes routing electromagnet WE II of routing means **106** which assumes the position shown for routing means **85***a* in FIG. **5***b*. The operation of key T **6** effects activation of a specific subprogram for the listing whose program commands follow each other for controlling computer RSW.

The card at the input station is sensed by light barrier LS **1** which generates a signal transmitted to computer RSW and indicates the presence of a card. The card is clamped between the transporting rollers **44, 51** and **42, 50** by energizing feed control electromagnet KK over line **121** and amplifier V **5**. Thereupon card feed clutch KE is energized over line **122** so that the transporting rollers transport a card in forward feeding direction through routing means **85**a in the normal position to the light barrier LS **2** which energizes the amplifier for magnetic head MK over line **124** so that the values recorded on record carrier strip **85** are read out and entered in the electronic storage means SP by way of computer RSW. By further program command, these values can be taken from storage means SP, and printed at the printing station by printing means **104, 105**. The card passes through the routing means **106** which is in the position for guiding the card into the receptacle **107**.

When the trailing edge of the card has passed through the photoelectric sensing means LS **2**, a signal is transmitted to computer RSW so that feed control electromagnet KK is de-energized, and another card can be supplied at the input station. With a certain delay caused by the distance between the photoelectric sensing means or light barrier LS **2** and the routing means **106**, the placing of a new card at the input station is thus permitted. The delay is of such duration that it is assured that the card has passed through routing means **106** before a new card is clamped by pressure rollers **50, 51** under the control of the feed control electromagnet KK. It will be seen that a card transported along a first path through the readout and recording station, is guided by routing means **106** in the normal position to a second path leading to the printing means **104, 105** and in the shifted position shown for routing means **85***a* in FIG. **5***b*, along a third path to receptacle **107**.

Assorting of Cards

The provision of two routing means **85***a* and **106** make assorting of the cards possible. The processing of accounts, such as the entry of values from vouchers on

the account, is not always manually done. Frequently, the vouchers which have to be processed are replaced by a punched card or by a punched tape, and the entering of the respective values takes place in an automatic operation. In this event, the cards are supplied to the input means in the order of the account numbers. The account numbers of the punch cards or punch tape and the sensing of the account number of card **58** in the readout station by magnetic head MK permits the control of the routing means **106** in accordance with a specific sub-program in such a manner that all account cards, on which no entries have to be made, are deposited in the receptacle **107**, while the other account cards, on which entries were made, are transported through routing means **106** in the normal position of FIG. 3 so that they are fed to the printing station where they are imprinted with the new data and then returned by reversing of the transporting roller until guided by the shifted routing means **85***a* into receptacle **86**.

The distance between the magnetic head MK and the printing station **104, 105** is so great that even the largest used card has passed completely through the readout station before a portion thereof arrives at the printing station. By suitably forming the line control strip **99** to **103**, see FIG. **8** and by a specific sub-program, it is possible to arrest card **58** before it arrives in the printing position, and to print certain data read out from record carrier strip **85** on a paper tape **104***a* consisting of interconnected forms, whereupon card **58** is transported into its printing position with the respective line placed in the plane of the printing hammers **105**, so that new data can be printed on the card.

Summary

The provision of routing means **85***a* and **106** cooperating with receptacles **86** and **107** makes it possible to use the apparatus for assorting of cards, and for listing the balances of accounts. By suitably controlling the routing means, cards can be deposited in a predetermined order. For example, one receptacle **86** can be used for receiving all account cards in which the balance has been changed, while the other receptacle **107** can be used for depositing all account cards where the balance has not been changed. The latter account cards need not be transported to the printing station, but can be automatically discharged and collected in the receptacle **107**.

When the apparatus is used for making lists of the account balances, recordings are read out from the record carrier strip **85** of card **58**, and the read out data are entered into storage means SP of computer RSW. When the apparatus is used for making lists, all cards can be run through the readout station and deposited into receptacle **107** without the necessity of transporting the card first to the printing station. The information of the data read out from the respective cards can be printed on a paper band **104a** so that of all data recorded on the cards, for example the last balance of the accounts, can be listed and printed without transporting the cards to the printing station.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of data processing apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in a card routing and assorting apparatus having a plurality of routing means and card receptacles, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. Card routing apparatus comprising a manually served input station for receiving a plurality of cards; a readout station having transducers responsive to indicia on said card; a receptacle in the proximity of said input station; routing means located between said input station and said readout station and being shiftable between a normal position for guiding a card in a forward feed direction from said input station to said readout station, and a discharge position for guiding a card when being fed in a reverse feed direction from said readout station into said receptacle, and including means for blocking in said discharge position, the movement of other cards out of said input station in said forward feed direction; first transporting means for transporting a card in said forward feed direction from said input station toward said readout station; second transporting means for transporting the card in said forward feed direction through said readout station, and being reversible for transporting the card through said readout station in said reverse feed direction to be guided by said routing means in said discharge position so that the card is discharged into said receptacle; and drive means for driving said first and second transporting means simultaneously in said forward feed direction to feed said card in said forward direction, and for driving said second transporting means in said reverse feed direction to feed said card in said reverse direction.

2. An apparatus as claimed in claim **1**, wherein said drive means include a one way clutch connecting said second transporting means with said first transporting means.

3. An apparatus as claimed in claim **1** wherein said routing means is biased to said normal position; comprising control means including a first routing electromagnet for moving said routing means to said discharge position; arresting means for holding said routing means in said discharge position, and a second routing electromagnet for releasing said arresting means so that said routing means returns to said normal position.

4. Card routing apparatus comprising an input station for receiving a plurality of cards; a readout station; a receptacle in the proximity of said input station; routing means located between said input station and said readout station and being shiftable between a normal position for guiding a card in a forward feed direction from said input station to said readout station, and a discharge position for guiding a card when being fed in a reverse feed direction from said readout station into said receptacle, and including means for blocking in said discharge position, the movement of other cards out of said input station in said forward feed direction; first transporting means for transporting a card in said forward feed direction from said input station toward said readout station; second transporting means for transporting the card in said forward feed direction through said readout station, and being reversible for transporting the card through said readout station in said reverse feed direction to be guided by said routing means in said discharge position so that the card is discharged into said receptacle; drive means for driving said first and second transporting means simultaneously in said forward feed direction to feed said card

in said forward direction, and for driving said second transporting means in said reverse feed direction to feed said card in said reverse direction; a printing station; third transporting means for transporting the card from said readout station; a second receptacle; and second routing means located between said second and third transporting means in the region of said second receptacle, and having a normal position for guiding cards from said second transporting means to said third transporting means in said forward feed direction and for guiding cards returned from said printing station by said third transporting means in said feed direction, to said second transporting means in said readout means, and having a discharge position for guiding to said second receptacle, a card transported in said forward direction by said second transporting means; and control means for moving said first and second routing means between said positions of the same so that selected cards are deposited in said first and second receptacles.

5. An apparatus as claimed in claim **4** wherein said card has a record carrier portion having recordings representing data; wherein said readout station includes a magnetic head for reading out said recordings; wherein said control means include storage means for storing said data; wherein said printing station has printing means controlled by said control means to print read out data while said card is guided by said second routing means away from said printing station and into said second receptacle.

6. An apparatus as claimed in claim **5,** wherein the distance between said readout station and said printing station is greater than the length of the card so that the trailing portion of the card transported in the forward feed direction has left said readout station before the leading portion thereof arrives at said printing station.

7. An apparatus as claimed in claim **4** wherein said input station includes a card table and a vertical guide wall for guiding one lateral edge of a card at said input station; wherein said input station and said first transporting means form a first unit; wherein said readout station and said second transporting means form a second unit; and wherein said printing station and said third transporting means form a third unit.

8. An apparatus as claimed in claim **7** wherein said third unit includes means for supplying a paper sheet to said printing station for printing thereon information read out from said cards at said readout station.

9. An apparatus as claimed in claim **7** wherein said guide wall is located at the left of said table; and wherein said control means includes a keyboard located at the right of said table for convenient manual operation.

10. Card routing apparatus comprising a manually served input station for receiving a plurality of cards; a readout station having transducers responsive to indicia on said card; a printing station; transporting means for transporting cards from said input station through said readout station to said printing station in a forward feed direction, and from said printing station through said readout station in a reverse feed direction; routing means between said readout station and said printing station, said routing means having a normal position connecting said readout station with said printing station for the passage of cards, and a discharge position for guiding a card to a discharge position when said card is fed to said routing means in said forward feed direction from said readout station; means for supplying a copy sheet to said printing station so that information read out from a card by said readout means is printed at said printing station on said copy sheet while the readout card is guided by said routing means in said discharge position to said discharged position; and means for shifting said routing means between said discharge position and said normal position so that other cards can be transported to and from said printing station while said routing means is in said normal position.

11. Card routing apparatus comprising a manually served input station for receiving a plurality of cards; a readout station having transducers responsive to indicia on said card; a printing station; transporting means for transporting cards from said input station through said readout station to said printing station in a forward feed direction, and from said printing station through said readout station in a reverse feed direction; routing means between said readout station and said printing station, said routing means having a normal position connecting said readout station with said printing station for the passage of cards, and a discharge position for guiding a card to a discharged position when said card is fed to said routing means in said forward feed direction from said readout station; means for supplying a copy sheet to said printing station so that information read out from a card by said readout means is printed at said printing station on said copy sheet while the read out card is guided by said routing means in said discharge position to said discharged position; means for shifting said routing means between said discharge position and said normal position so that other cards can be transported to and from said printing station while said routing means is in said normal position and another routing means for guiding said other cards when transported in said reverse feed direction to another discharged position, and having a shifted position for guiding cards in said forward feed direction from said input means to said readout station.

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